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SID 62-99-26

MONTHLY WEIGHT AND BALANCE REPORT

FOR THE APOLLO SPACECRAFT

CONTRACT NAS 9-150 *56*

(U)

PARAGRAPH 8.10 EXHIBIT I

1 APRIL 1964



CLASSIFICATION CHANGE
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Prepared by
Weight Control

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SPACE and INFORMATION SYSTEMS DIVISION

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INTRODUCTION

The April report continues to utilize the current Airframe 011 drawing release as a basis. The current weight status summarizes the changes from the previous Airframe 011 weight, and incorporates the estimated changes for the LOR Mission Spacecraft. This format allows weight status reporting consistent with airframe release and continuous updating of the estimated LOR changes.

The current report reflects a LOR spacecraft increase of 4285 pounds at injection and 5340 pounds at the injected spacecraft condition less Service Module propellant. The current injected weight of 90210 pounds is based on a Service Module propellant loading for a specific impulse of 313.0 sec., and ΔV budget of the MSC Letter PE5-64-78 dated approximately 11 February 1964, Subject Contract NAS 9-150, Velocity Budget, Target Weight and Mission Plans. The Lunar Excursion Module weight has increased 5040 pounds to the 29,500 pound control weight, excluding crew.

The major changes in the Command Module were due to increases in wiring based on current calculations of airframe requirements and a revision to the estimated wiring changes to the LOR mission, increase in Guidance and Navigation based on latest MIT status, and an increase in the crew survival kit based on current requirements.

The major changes in the Service Module were due to increases in wiring based on current calculations of airframe requirements and a revision to the estimated wiring changes to the LOR mission, and an increase in intermodular radiator plumbing required to connect the enlarged radiator area.

The major changes in the Launch Escape System were due to an increase in structure based on the addition of the Canard Abort Recovery Concept to replace the tower flap and upper plane separation, and an increase in ballast consistent with the combined Launch Escape and Command Module balance requirements. The LOR Spacecraft Dimensional Diagram will be revised to reflect this change in future reports.

The major changes in the Adapter were due to increases in frame, rings and separation provision based on a new method of separation.

The Earth Orbital Mission Weight Summary reflects a two stage Booster-to-Orbit injection without the use of Service Module propulsion and is based on a complete Service Module loaded with 2425 pounds of deorbit propellant. The Earth Orbit weight reported limits the orbital altitude capability with the Saturn I booster to 58.5 nautical miles. To obtain the 100 nautical mile orbital altitude with the Saturn I booster requires off loading items from the Command Module and Service Module.

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APOLLO LOR MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10200	1043.7	0.8	6.1	4791	4437	4146
SERVICE MODULE-Less Propellant	10015	907.9	0.4	-0.4	6402	10653	10484
TOTAL-Less Propellant	20215	976.4	0.6	2.9	11239	35251	34745
PROPELLANT-S/M**	37020	905.7	5.9	-2.5	18994	19754	26214
TOTAL-With Propellant	57235	930.7	4.0	-0.6	30394	69202	75154
LUNAR EXCURSION MODULE	29500	596.4	-0.3	-0.3	19769	18875	18494
ADAPTER - LEM - C-5	3475	657.0	0.0	0.0	8504	11778	11778
TOTAL-Injected	90210	810.8	2.5	-0.5	58751	587822	593476
LAUNCH ESCAPE SYSTEM	7615	1306.0	0.0	0.0	290	15039	15043
TOTAL-SPACECRAFT LAUNCH	97825	849.4	2.3	-0.4	59051	974512	980179

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

**The propellant weight of 38075 pounds is determined from an estimated time line analysis. The propellant weight is based on a specific impulse of 313.0.

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APOLLO EARTH ORBIT MISSION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10200	1043.7	0.8	6.1	4791	4437	4146
SERVICE MODULE - Less Propellant	10015	907.9	0.4	-0.4	6402	10653	10484
TOTAL - Less Propellant	20215	976.4	0.6	2.9	11239	35251	34745
PROPELLANT - S/N**	2425	849.0	27.3	-11.5	815	4444	564
TOTAL - With Propellant	22640	962.8	3.5	1.3	12484	43380	43230
ADAPTER - C-1	885	778.5	-0.3	-0.5	1058	868	820
TOTAL - Injected	23525	955.8	3.3	1.3	13545	50491	50295
LAUNCH ESCAPE SYSTEM	7615	1306.0	0.0	0.0	290	15039	15043
TOTAL - Spacecraft Launch	31140	1041.5	2.5	1.0	13851	217779	217599

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

**The earth orbital weights are based on a complete service module and includes 2425 pounds of propellant for an orbital altitude of about 58.5 nautical miles with a payload launch azimuth of 72°.

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APOLLO LAUNCH ABORT CONFIGURATION

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

ITEM	WEIGHT POUNDS	CENTER OF GRAVITY*			MOMENTS OF INERTIA (SLUG-FT. ²)		
		X	Y	Z	ROLL (X)	PITCH (Y)	YAW (Z)
COMMAND MODULE	10200	1043.7	0.8	6.1	4791	4437	4196
LAUNCH ESCAPE SYSTEM	7615	1306.0	0.0	0.0	290	15039	15043
TOTAL - Launch Abort	17815	1155.8	0.5	3.5	5117	84258	83937
LESS - MAIN AND PITCH MOTOR PROPELLANTS	-3205	1296.2	0.0	0.0	-69	-1299	-1299
TOTAL - LES Burnout	14610	1125.0	0.6	4.3	5037	66326	66014

NOTES: *Centers of gravity are in the NASA reference system except that the longitudinal axis has an origin 1000 inches below the tangency point of the command module substructure mold line.

COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LUNAR ORBIT RENDEZVOUS MISSION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT. ²)					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10200	1043.7	0.8	6.1	4791	4437	4146	-12	-208	-37
ADJUSTMENTS (NET)	-45									
Boost & Mission Coolants										
Food & Water Consumption										
Mission Waste Pickup										
Fuel Cell Water Pickup										
Docking Provisions										
Ablator B/O, Boost										
PRIOR TO ENTRY	10155	1042.6	0.9	6.3	4790	4362	4065	1	-221	-35
Less: Propellant	-135	1022.6	-5.1	56.6						
Ablator Burnoff	-240	1024.4	0.0	12.5						
Entry Coolant	-6	1022.6	-63.4	-16.4						
Forward Heat Shield	-336	1098.3	-0.1	3.4						
Drogue Chutes	-50	1090.0	0.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9388	1041.1	1.1	5.7	4443	3823	3587	-	-162	-28
Less: Main Chutes (3)	-450	1091.7	-0.3	7.7						
Propellant	-135	1022.6	-5.1	56.6						
LANDING	8803	1038.8	1.2	4.8	4288	3458	3252	4	-149	-18

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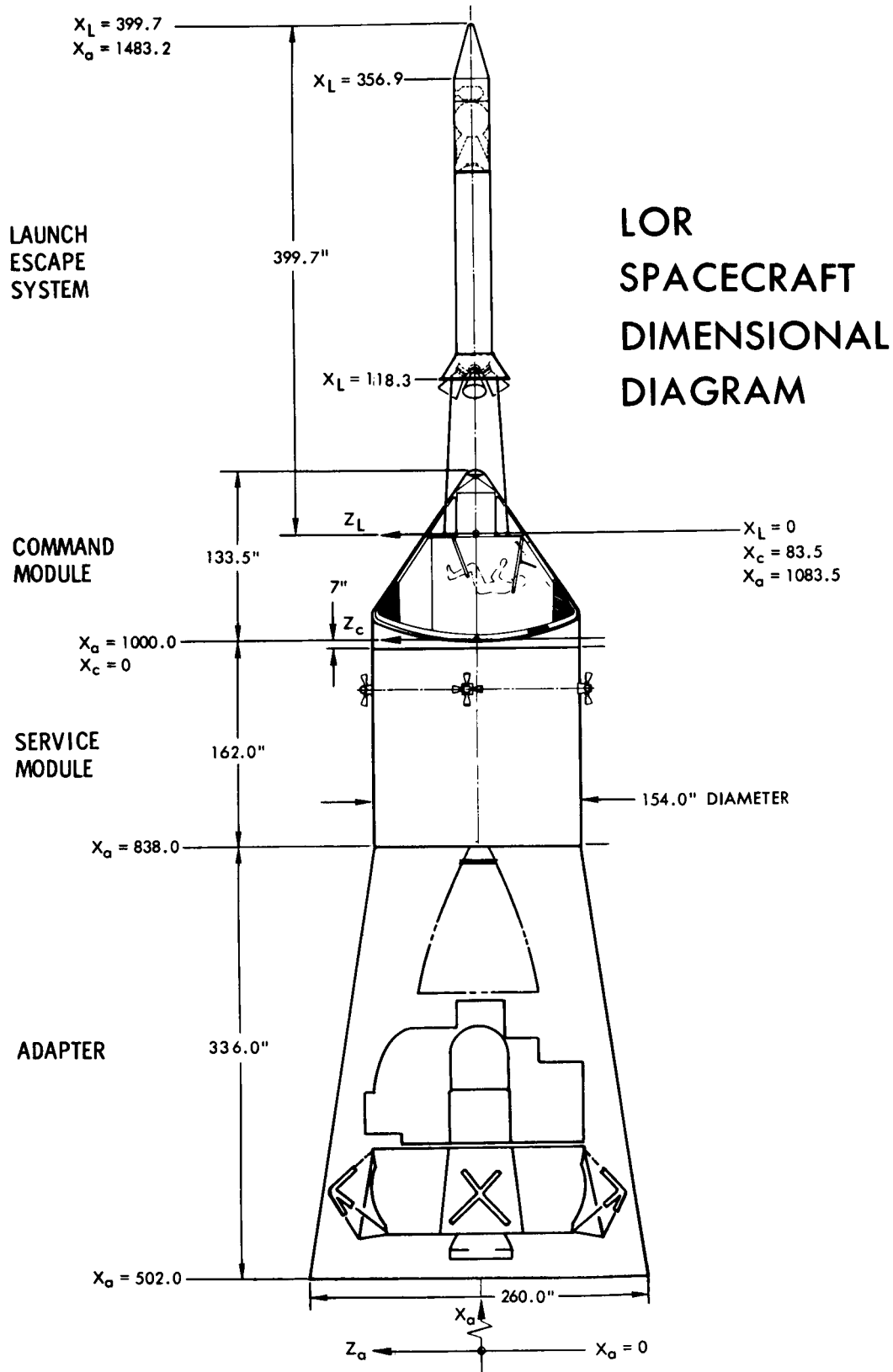
COMMAND MODULE

WEIGHT, CENTER OF GRAVITY AND INERTIA SUMMARY

LOW ALTITUDE ABORT CONDITION

VEHICLE MODE	WEIGHT POUNDS	CENTER OF GRAVITY			MASS INERTIA DATA (SLUG-FT. ²)					
		X	Y	Z	Ixx	Iyy	Izz	Ixy	Ixz	Iyz
COMMAND MODULE, LAUNCH	10200	1043.7	0.8	6.1	4791	4437	4146	-12	-208	-37
Less: Oxidant	-180	1022.6	15.6	62.4						
Forward Heat Shield	-336	1098.3	-0.1	3.4						
Docking Provisions	-100	1110.0	0.0	0.0						
Drogue Chute	-50	1090.0	0.0	-22.0						
PRIOR TO MAIN CHUTE DEPLOYMENT	9534	1041.2	0.6	5.3	4574	3896	3723	5	-132	-67
Less: Main Chutes (3)	-450	1091.7	-0.3	7.7						
Fuel	-90	1022.6	-46.5	44.9						
LANDING	8994	1038.9	1.1	4.8	4448	3581	3373	-6	-132	-33

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SPACECRAFT

WEIGHT STATUS SUMMARY

(LESS LEM)

ITEM	PREVIOUS AFRM O11 STATUS 3-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM O11 WEIGHT 4-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 4-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
COMMAND MODULE	10310	+130	10440	-240	10200	36	64	
SERVICE MODULE - B/O	9790	+90	9880	+135	10015	17	73	10
LES	7170	+330	7500	+115	7615	44	49	7
ADAPTER	885		885	+2590	3475	100		
TOTAL LESS PROPELLANT	28155	+550	28705	+2600	31305	39	56	5
PROPELLANT	-	-	-	-	37020		100	
GROSS WEIGHT	-	-	-	-	68325	18	80	2

INJECTED SPACECRAFT

WEIGHT STATUS

ITEM	PREVIOUS LOR STATUS 3-1-64	CHANGE TO CURRENT	CURRENT LOR STATUS 4-1-64
COMMAND MODULE	10040	+160	10200
SERVICE MODULE	9950	+65	10015
ADAPTER	3400	+75	3475
LEM	24460	+5040	29500
TOTAL S/C Injected Less Propellant	47850	+5340	53190
PROPELLANT	38075	-1055	37020
TOTAL INJECTED WEIGHT	85925	+4285	90210

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COMMAND MODULE WEIGHT STATUS

ITEM	PREVIOUS AFRM OIL STATUS 3-1-64	CHANGES TO CURRENT AFRM	CURRENT AFRM OIL WEIGHT 4-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 4-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure Structure - Less Ablator Ablation Material	(4770) 3417 1353	(-8) -8	(4762) 3409 1353	(-63) +17 -80	(4699) 3426 1273	15 100	85	
Stabilization & Control	248		248	-22	226	14	86	
Guidance & Navigation	441	+18	459	-8	451	54	46	
Crew Systems	387	+55	442	-20	422	4	96	
Environmental Control	288	+23	311	-17	294	27	73	
Earth Landing System	705	-1	704		704	13	84	3
Instrumentation	659	-37	622	-326	296	43	57	
Electrical Power	533	+57	590	-34	556	83	17	
Reaction Control	339	-7	332	-2	330	62	38	
Communications	361	+8	369	-9	360	23	77	
Controls & Displays	323	+20	343	-24	319	21	78	
WEIGHT EMPTY	9054	+128	9182	-525	8657	37	63	
Scientific Equipment	-	-	-	+250	250	100		
Crew Systems	835	+11	846	+36	882	30	60	4
Reaction Control	270		270		270		100	
Environmental Control	151	-9	142	-1	141		100	
GROSS WEIGHT	10310	+130	10440	-240	10200	36	64	

~~CONFIDENTIAL~~COMMAND MODULECURRENT AIRFRAME WEIGHT EMPTY CHANGESSTRUCTURE (-8.0)

Delete the food stowage container provisions as this requirement is accomplished in crew system design. -8.0

GUIDANCE AND NAVIGATION (+18.0)

Increase Guidance and Navigation System due to incorporation of MIT Weight Reports for December and January reflecting the following changes: +17.6

Decrease in Coupling Display Unit based on actual in lieu of estimated weights. -2.0

Increase in Bellows Assembly based on actual in lieu of estimated weights. +0.9

Increase in Optical Equipment based on calculated in lieu of estimated weights. +2.9

Decrease in Film Cartridges, CDU Spare Box and Horizon Photometer based on revised estimates. -1.5

Increase in Computer Spare Memory Tray. +17.3

Increase NAA cabling based on revised estimate. +0.4

CREW SYSTEMS (+55.0)

Delete map and manual case assembly as this item is replaced by the flight kit carried in Useful Load. -2.0

Increase crew couch structure due to adding foot rest covers and a foot rest spirator motor. +5.9

Transfer the following items from Useful Load: +27.7

Shoe Straps - Weightless Restraint	+2.0
Delivery Assembly - Water	+1.5
Umbilical Assembly - Suit	+17.9
Hose Assembly - PLSS oxygen recharge	+2.8
Electrical Umbilical - PGA	+2.5
Relief Receptacle - Crewman	+1.0

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~~CONFIDENTIAL~~COMMAND MODULECURRENT AIRFRAME WEIGHT EMPTY CHANGESCREW SYSTEMS (Cont'd.)

Transfer window filters from electrical power system lighting.	+3.8
Decrease waste management system based on calculation of current drawings.	-0.4
Add a food storage container based on calculation of released drawings.	+20.0

ENVIRONMENTAL CONTROL

(+23.0)

Increase water-glycol circuit due to adding a radiator controller to provide automatic temperature control for the Environmental Control System radiator flow valves.	+5.6
Increase water-glycol plumbing due to calculation of released drawings.	+4.3
Increase subcontractor common items due to addition of test points to the ECS to permit check-out of individual components during system check-out.	+2.6
Add control provisions for the Service Module temperature control system which provides required heating and cooling to the Service Module Reaction Control System.	+10.0
Increase oxygen supply system due to adding an oxygen emergency flow mode sensor to detect excess oxygen flow rate and provide actuating signal to warn crew of emergency condition.	+0.2
Increase water supply system due to adding a shut off valve at the drinking water hose connection to permit replacement of hose assembly without the loss of water.	+0.3

EARTH LANDING SYSTEM

(-1.0)

Decrease location aids due to deleting the flashing light as this item is now a part of the survival kit.	-1.0
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~~CONFIDENTIAL~~COMMAND MODULECURRENT AIRFRAME WEIGHT EMPTY CHANGESINSTRUMENTATION

(-37.0)

Decrease PCM equipment based on Collins' Report reflecting actual in lieu of calculated weights. -0.6

Decrease instrumentation electrical provisions based on calculations of current airframe wiring diagrams. -36.4

ELECTRICAL POWER

(+57.0)

Decrease lower equipment bay panel based on vendor reports on the motor switches. -1.2

Decrease ground power provisions due to relocating the GSE DC power connector from the Command Module to the Service Module to allow GSE DC power to main buses after closing Command Module hatch. -1.5

Add phase correcting capacitor to control the output requirement of the inverters. +6.0

Add an inverter bus selection control to the main power control panel to eliminate excessive power loss and voltage drop in input circuit of Number 3 inverter. +1.0

Transfer window filters to Crew Systems as this group now controls their function. -3.8

Provide a sequencer system to perform separation of the spacecraft from the booster during normal spacecraft - booster separation or a service propulsion system abort situation. +12.0

Increase electrical provisions based on calculations of current airframe wiring diagrams. +44.5

REACTION CONTROL

(-7.0)

Decrease engines based on Rocketdyne Status Report reflecting weight reduction effort reducing excess material in valves and valve supports. -9.6

Increase electrical provision based on calculations of current airframe wiring diagrams. +2.6

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~~CONFIDENTIAL~~COMMAND MODULECURRENT AIRFRAME WEIGHT EMPTY CHANGES

<u>COMMUNICATIONS</u>	(+8.0)
Increase C-Band transponder due to adding beef-up for flatness signal conditioning and a temperature sensor per Collins' status.	+2.0
Increase electrical provisions based on calculations of current airframe wiring diagrams.	+6.0
<u>CONTROLS AND DISPLAYS</u>	(+20.0)
Increase flight director attitude indicator due to providing a rear mounting per Minneapolis-Honeywell status.	+0.9
Decrease delta velocity indicator due to deleting the tail-off switch per Minneapolis-Honeywell status.	-0.1
Increase mounting panels due to removing the chem-etch from Airframe 011 to provide design flexibility.	+5.6
Increase Main Display Guidance and Navigation computer keyboard due to the addition of spare relays and partial actual weights reflected in MIT report.	+4.5
Add control panel required for the Service Module temperature control system.	+3.0
Decrease lower equipment bay Guidance and Navigation navigator controls due to partial actual weights reflected in MIT report.	-0.4
Decrease lower equipment bay Guidance and Navigation map and data viewfinder based on MIT report reflecting calculated in lieu of estimated weight.	-0.8
Increase lower equipment bay Guidance and Navigation computer keyboard due to the addition of spare relays and partial actual weights reflected in MIT report.	+4.6
Decrease manual rotational control due to redesign per Minneapolis-Honeywell status.	-0.8

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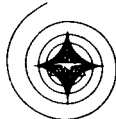
~~CONFIDENTIAL~~COMMAND MODULECURRENT AIRFRAME WEIGHT EMPTY CHANGESCONTROLS AND DISPLAYS (Cont'd.)

Increase caution and warning detector based on latest Autonetics estimate.	+5.5
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Decrease electrical provisions based on calculation of current airframe wiring diagrams.	-2.0
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TOTAL COMMAND MODULE CURRENT AIRFRAME WEIGHT EMPTY CHANGES	+128.0
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~~CONFIDENTIAL~~COMMAND MODULECURRENT AIRFRAME USEFUL LOAD CHANGESCREW SYSTEMS

(+11.0)

Increase constant wear garments due to changing the unit weights
from 1.0 pounds each to 1.4 pounds each and reducing the quantity
from 12 to 9 per NASA Interface Meeting. +0.6

Transfer the following item to weight empty Crew Systems: -27.7

Shoe Straps - Weightless Restraint	-2.0
Delivery Assembly - Water	-1.5
Umbilical Assembly - Suit	-17.9
Hose Assembly - PLSS Oxygen Recharge	-2.8
Electrical Umbilical - PGA	-2.5
Relief Receptacle - Crewman	-1.0

Add two flight kits which replace the map set, manual set, logbook,
lapboard and map and manual case. +5.0

Increase inflight maintenance tool set based on calculation of current
layout drawings. +2.5

Increase medical equipment due to calculation of current released
drawings for the medical storage required for the early airframes. +1.5

Increase personal hygiene equipment due to calculation of current
released drawings for the hygiene storage required for the early
airframes. +4.5

Increase survival kit due to the following: +22.5

Increase in container based on actual weights.	+16.8
Addition of location dye based on NASA letter 7224 MA requiring location dye for a 24 hour capacity.	+6.4
Addition of a transceiver to replace SARAH Beacon based on current crew systems requirement.	+8.2
Addition of life vests, balloon kite and light assembly per current survival kit requirements.	+2.6
Decrease in first aid kit based on revised estimate of requirements.	-2.5
Reduction of life rafts due to design refine- ment utilizing higher strength to weight material.	-9.0

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~~CONFIDENTIAL~~COMMAND MODULECURRENT AIRFRAME USEFUL LOAD CHANGESCREW SYSTEMS (Cont'd.)

Increase personal communication based on current calculation of released drawings.	+2.1
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<u>ENVIRONMENTAL CONTROL</u>	(-9.0)
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Decrease lithium hydroxide based on new CO ₂ rates using 2.12 pounds/man/day in lieu of 2.30 pounds/man/day.	-9.0
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TOTAL COMMAND MODULE CURRENT USEFUL LOAD CHANGES	+2.0
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SERVICE MODULE WEIGHT STATUS

ITEM	PREVIOUS AFRM OLL STATUS 3-1-64	CHANGES TO CURRENT AFRM	CURRENT AFRM OLL WEIGHT 4-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 4-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure	2220	+5	2225	+65	2290	11	74	15
Environmental Control	92	+78	170	-80	90	20	79	1
Instrumentation	174	-42	132		132	26	74	
Electrical Power	1397	+37	1434	-8	1426	12	40	48
Propulsion System	(3063)	(+1)	(3064)		(3064)	50	50	
Engine Installation	712		712		712	13	87	
Propulsion System	2351	+1	2352		2352	61	39	
Reaction Control	602	-1	601		601	100		
Communications & Rendezvous Radar	12	+12	24	+158	182			
WEIGHT EMPTY	7560	+90	7650	+135	7785	22	65	13
RCS Propellant	838		838		838		100	
Electrical Power Super. Fluids	503		503		503		100	
Environmental Contr. Super. Fluids	208		208		208		100	
Main Propulsion Helium	99		99		99		100	
Main Propulsion Residuals	(582)		(582)		(582)		100	
Trapped - System	225		225		225			
Trapped - Engine	67		67		67			
Mixture Ratio Tolerance	100		100		100			
Loading Tolerance	190		190		190			
BURNOUT WEIGHT	9790	+90	9880	+135	10015	17	73	10
Main Propellant					37020		100	
GROSS WEIGHT					47035	4	94	2

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~~CONFIDENTIAL~~SERVICE MODULECURRENT AIRFRAME WEIGHT EMPTY CHANGESSTRUCTURE (+5.0)

Increase Command Module to Service Module fairing due to the addition of an umbilical fairing for larger umbilical capacity. +5.0

ENVIRONMENTAL CONTROL (+78.0)

Increase water glycol circuit and common items due to the requirement to provide automatic temperature control for the Environmental Control System radiator flow valves. +2.9

Decrease space radiators due to calculation of two of the four panels reflecting a reduction in area from that of previous layouts. -2.1

Decrease water-glycol plumbing due to a change in tubing from steel to aluminum. -2.8

Add Service Module temperature control system to provide required heating and cooling to the Service Module Reaction Control System. +80.0

ELECTRICAL POWER (+37.0)

Increase fuel cell power pack per Pratt and Whitney status reflecting minor weight changes. + .3

Increase intermodular radiator plumbing due to additional plumbing and valves required to connect the enlarged radiator area in Bays I and IV to accomplish deep space and lunar orbit mission. +16.2

Increase cryogenic oxygen tanks due to a change in tank membrane and taper thickness based on new maximum stress reflected in the procurement specification. +8.4

Decrease fuel cell module stabilization webs due to calculation of current drawings. -0.9

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~~CONFIDENTIAL~~SERVICE MODULECURRENT AIRFRAME WEIGHT EMPTY CHANGESELECTRICAL POWER (Cont'd.)

Increase the GSE fly-away umbilical due to the addition of the GSE DC power connector which has been relocated from the Command Module to the Service Module. This change is being made in compliance with NASA direction to enable GSE DC power to supply the Command Module and Service Module main buses while on the launch platform, after closing Command Module hatch and removing service tower. +6.2

Increase electrical provisions based on calculations of current airframe wiring diagrams. +6.8

INSTRUMENTATION (-42.0)

Decrease electrical provisions based on calculations of current airframe wiring diagrams. -42.0

MAIN PROPULSION (+1.0)

Increase electrical provisions based on calculations of current airframe diagrams. +1.0

REACTION CONTROL (-1.0)

Decrease electrical provisions based on calculations of current airframe diagrams. -1.0

COMMUNICATIONS (+12.0)

Increase common utility electrical wiring based on calculations of current airframe diagrams. +12.0

TOTAL SERVICE MODULE CURRENT AIRFRAME WEIGHT EMPTY CHANGES +90.0

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~~CONFIDENTIAL~~LAUNCH ESCAPE SYSTEMWEIGHT STATUS

ITEM	PREVIOUS AFRM O11 STATUS 3-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM O11 WEIGHT 4-1-64	ESTIMATED CHANGES TO LOR	CURRENT LOR WEIGHT 4-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure	1033	+281	1314		1314	42	58	
Electrical System	102	-17	85		85	5	95	
Propulsion System								
Main Thrust	4767		4767		4767	40	60	
Jettison	434		434		434			100
Jettison Motor								
Skirt	92		92		92			100
Pitch Control	47		47		47	60	40	
Separation Provisions	49	-36	13		13		100	
C/M Boost Prot. Cover				+185	185	100		
LES - NO BALLAST	6524	+228	6752	+185	6937	39	54	7
BALLAST	646	+102	748	-70	678	100		
TOTAL L.E.S.	7170	+330	7500	+115	7615	44	49	7

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~LAUNCH ESCAPE SYSTEMCURRENT AIRFRAME CHANGESSTRUCTURE (+281)

Increase structure due to the addition of a Canard Abort Recovery System in lieu of the tower flap to orient the Launch Escape Vehicle in a heat shield forward attitude prior to parachute deployment.

+281

SEPARATION PROVISIONS (-36)

Decrease separation provisions as the addition of the Canard Recovery System in lieu of the tower flap eliminates the upper plane separation between the tower structure and escape motor.

-36

ELECTRICAL POWER (-17)

Decrease electrical power as the addition of the Canard Abort Recovery System in lieu of the tower flap eliminates the upper plane separation between the tower structure and escape motor which deletes the requirement for an added sequencer and wiring.

-17

BALLAST (+102)

Increase ballast consistent with new combined Command Module and LES balance requirements about Station 1125 in lieu of Station 1116.

+462

Decrease ballast due to the addition of the Canard Abort Recovery System which is located in the ballast area and supplants ballast. -360

TOTAL LAUNCH ESCAPE SYSTEM CURRENT AIRFRAME WEIGHT CHANGES

+330~~CONFIDENTIAL~~

~~CONFIDENTIAL~~ADAPTERWEIGHT STATUS

ITEM	PREVIOUS AFRM 011 STATUS 3-1-64	CHANGE TO CURRENT AFRM	CURRENT AFRM 011 WEIGHT 4-1-64	ESTIMATED CHANGE TO LOR	CURRENT LOR WEIGHT 4-1-64	BASIS FOR CURRENT LOR STATUS		
						%EST	%CAL	%ACT
Structure	709		709	+2261	2970			
Electrical	20		20	+50	70			
Separation System	156		156	+279	435			
TOTAL ADAPTER	885		885	+2590	3475	100		

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~~CONFIDENTIAL~~COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO LORSTRUCTURE

(-63)

- Eliminate the heat shield substructure face sheet pads (scar weight) provided on the first few spacecrafts for designs that were not consummated (strakes, plugs, vents, etc.). -26
- Analyze structure design in detail based on a refinement of loading conditions, as the original design was accomplished on an extremely tight schedule utilizing a minimum of loads and equipment information. -40
- Incorporate a boost protection cover over the Command Module nose to be jettisoned with the Launch Escape System tower. This would allow the ablative material thickness on the nose to be reduced. -30
- Reduce the spacecraft temperature criteria from 250°F to 200°F. A saving of approximately one pound of ablative material can be removed for every degree reduction at start of entry. -50
- Refine secondary structure design by additional machining of extrusions utilized in coldplate closeouts, alternate materials, and a reduction of supports for scientific equipment. -60
- Reduce heat shield window glass thickness from 0.70 inch to 0.55 inch based on a more detailed thermal and structural analysis. -10
- Add LEM docking provisions for the LOR mission. +150
- Add lower equipment bay supports required for food compartments which were accomplished on Airframe 011 by a food storage box designed by Crew Systems. +8
- Decrease umbilical installation structure due to removing the added umbilical required for airframe instrumentation as the LOR wiring requirements have not been defined at this time. -5

STABILIZATION AND CONTROL

(-22)

- Remove all elapsed time indicators prior to flight. -1
- Utilized partial potting in low dissipation ECA modules. -5

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~~CONFIDENTIAL~~COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO LORSTABILIZATION AND CONTROL (Cont.)

Reduce total length of ECA package. Packages are presently designed to include growth capabilities. -3

Delete multiple monitor relays in DC amplifiers. -1

Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis. -12

GUIDANCE AND NAVIGATION

(-8)

Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis. -8

CREW SYSTEMS

(-20)

Decrease food storage boxes as the design for the LOR vehicle will be accomplished by the secondary structure supports in lieu of using a removable stowage as is used on Airframe 011 -20

ENVIRONMENTAL CONTROL

(-17)

Utilize a combined tank with separate compartments for waste water and potable water. -4

Delete re-entry backup oxygen system as the LOR vehicle has the requirement to carry one PLSS which may be utilized for backup. -3

Delete provisions for Service Module temperature control system as the requirements for the LOR vehicle have not been thoroughly defined at this time. -10

INSTRUMENTATION

(-326)

Delete instrumentation required for flight qualification. -305

Decrease electrical wiring due to utilizing thin wall teflon insulation where possible, reducing wire gage based on electrical load analysis and reducing instrumentation wiring by utilizing unshielded wire where possible. -38

~~CONFIDENTIAL~~

~~CONFIDENTIAL~~COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO LORINSTRUMENTATION (Cont.)

Add Nuclear Radiation Detection required for the lunar vehicle that was previously assumed to be on Airframe 011. +17

ELECTRICAL POWER

Decrease umbilical due to deleting extra umbilical added on early airframes as the LOR wiring requirements have not been defined at this time. -14

Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis. -20

REACTION CONTROL

(-2)

Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis. -2

COMMUNICATIONS

(-9)

Decrease electrical wiring due to utilizing thin wall teflon installation where possible and reducing wire gage based on electrical load analysis. -9

CONTROLS AND DISPLAYS

(-24)

Reduce weight of displays by utilizing lamps in lieu of the barometric pressure indicator and by sharing cryogenic pressure and quantity readouts between the hydrogen and oxygen requirements. -4

Delete the self-test capability of the SCS displays. -2

Chem-etch mounting panels for the LOR vehicles that could not be accomplished due to schedule on Airframe 011. -4

Delete present reaction jet solenoid power switching relays from the SCS mode select panel. Utilize a manual switch and circuit breakers for reaction jet solenoid power control. -2

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~~CONFIDENTIAL~~COMMAND MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO LORCONTROLS AND DISPLAYS (Continued)

Replace roll attitude error needle servo drive with galvanometer movement.	-1
Add rendezvous radar panel required for LOR mission.	+13
Delete console interface connectors resulting in some complications in manufacturing and repair of console.	-9
Decrease electrical wiring due to utilizing thin wall teflon insulation where possible and reducing wire gage based on electrical load analysis.	-15
Add Nuclear Radiation Displays required for the lunar vehicle that was previously assumed to be on Airframe Oll.	+3
Delete Service Module temperature control panel as the requirement for the LOR vehicle have not been thoroughly defined at this time.	-3
<hr/>	
TOTAL COMMAND MODULE CURRENT ESTIMATED WEIGHT EMPTY CHANGES TO LOR	-525

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~~CONFIDENTIAL~~COMMAND MODULECURRENT ESTIMATED USEFUL LOAD CHANGES TO LOR

<u>SCIENTIFIC EQUIPMENT</u>	(+250)
Add scientific equipment based on current LOR mission requirements.	+250
<u>CREW SYSTEMS</u>	(+36)
Add one portable life support system to the LOR vehicle as the requirement for this still exists.	+42
Decrease hygiene and medical storage boxes based on redesign of container that can not be accomplished on Airframe 011.	-6
<u>ENVIRONMENTAL CONTROL</u>	(-1)
Delete re-entry oxygen required for airframes that do not carry a portable life support system.	-1
<hr/>	
TOTAL COMMAND MODULE CURRENT ESTIMATED USEFUL LOAD CHANGES TO LOR	+285

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~~CONFIDENTIAL~~SERVICE MODULECURRENT ESTIMATED WEIGHT EMPTY CHANGES TO LOR

<u>STRUCTURE</u>	(+65)
Add structural beef-up required to support the rendezvous radar equipment.	+40
Add structural provisions for supporting the high gain antenna, previously assumed to be on Airframe 011.	+30
Decrease umbilical installation structure due to removing the added fairing for the larger umbilical required for airframe instrumentation as the LOR wiring requirements have not been defined at this time.	-5
<u>ENVIRONMENTAL CONTROL</u>	(-80)
Delete Service Module temperature control system as the requirements for the LOR vehicle have not been thoroughly defined at this time.	-80
<u>ELECTRICAL POWER</u>	(-8)
Decrease umbilical due to deleting extra umbilical added on early airframes as the LOR wiring requirements have not been defined at this time.	-8
<u>COMMUNICATIONS & RENDEZVOUS RADAR</u>	(+158)
Add high gain antenna required for deep space communications. This item was previously assumed to be in Airframe 011.	+38
Add rendezvous radar equipment consistent with the LOR requirements.	+120
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TOTAL SERVICE MODULE ESTIMATED WEIGHT EMPTY CHANGES TO LOR	+135

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~~CONFIDENTIAL~~LAUNCH ESCAPE SYSTEMCURRENT ESTIMATED WEIGHT CHANGES TO LORSTRUCTURE

(+185)

Add a boost heat shield for protection of the forward compartment during boost heating. The addition of the boost heat shield reduces the forward compartment heat shield ablative thickness and lightens the injected spacecraft weight.

+185

BALLAST

(-70)

Decrease ballast consistent with current Command Module LES balance requirements.

-70

TOTAL LAUNCH ESCAPE SYSTEM CURRENT ESTIMATED WEIGHT CHANGES TO LOR

+115

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~~CONFIDENTIAL~~ADAPTERCURRENT ESTIMATED WEIGHT CHANGES TO LOR

Utilize the S-IV B Adapter consistent with the current LOR mission requirements in lieu of the S-IV Airframe 011 Adapter.

+2590

NOTE: Increase LEM Adapter due to the following changes: +75

Decrease in honeycomb panels due to a decrease in core based on changing the core depth from a tapered (1.5 to 2.5 inch) core to a constant (1.7 inch) core, an increase in face sheet thickness based on revised stress inputs and the deletion of closeouts at vertical panel joints between station 502.0 and 584.7.	-37
Increase in longerons at panel splices, based on latest stress inputs.	+2
Increase in frames and rings due to revising the ring at Station 838 based on a new ring design and revised separation method, increasing the ring at Station 584.7 to incorporate a field splice and provisions for mounting the LEM and an increase in ring at Station 502 based on current load requirements.	+98
Decrease in LEM supports due to mounting LEM at ring in lieu of panel.	-16
Decrease in insulation due to reducing the corkboard thickness from .08 to .04 inch based on a reduction in temperature.	-169
Increase of separation system based on latest layout drawings reflecting a revised system and an increase in back-up structure for the shaped charges.	+147
Increase in paint and miscellaneous attach provisions.	+50

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~~CONFIDENTIAL~~WEIGHT HISTORY COMMENTS

LAUNCH ESCAPE SYSTEM

The design goal established for the LES is 6,300 pounds, excluding ballast. This weight was based on the September 1962 status weight of 6,600 pounds, including the necessary ballast to provide currently determined aerodynamic stability to prevent tumbling.

The original design goal of 5,900 pounds, as reported in the June status, SID 62-99-5, was based on an attitude controlled configuration. The current configuration weight includes a pitch motor and ballast not included in the original target weight.

COMMAND MODULE

The design goal established for the Command Module is 8,500 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes.

The original design goal weight of 8,340 pounds, as reported in the June status, SID 62-99-5, did not include the proposed increases nor the Category I reductions presented in the July briefing and incorporated in the July Status Report.

SERVICE MODULE

The design goal established for the Service Module less usable propellant is 11,000 pounds. An estimated weight breakdown for the design goal is provided for comparative purposes. This configuration is sized for 45,000 pounds usable propellant for the 25,000 pound LEM.

The original design goal weight of 8,595 for the burnout condition was based on lunar configuration sized for 31,000 pounds usable propellant.

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WEIGHT HISTORY

COMMAND MODULE

ITEM	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 4-1-64
Structure	3824	+277	4101
Stabilization & Control	181		181
Guidance & Navigation	261	+180	441
Crew System	530		530
Environmental Control	235	-11	224
Earth Landing System	610		610
Instrumentation	173	+7	180
Electrical Power	390	+9	399
Reaction Control	195		195
Communication	330	+33	363
Controls & Displays	261	+21	282
WEIGHT EMPTY	6990	+516	7506
Scientific Equipment	250		250
Crew	528		528
Suits & Personal Equipment	304	-8	296
Food & Containers	90		90
Reaction Control Propellant	210		210
Environmental Control Fluids	128		128
GROSS WEIGHT	8500	+508	9008

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~~CONFIDENTIAL~~COMMAND MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES

STRUCTURE	(+277)
Change parachute attach to a two leg configuration for incorporation of the "Tumbling Concept" at earth impact attenuation. (CCA No. 93)	+125
Delete the extendable heat shield window covers and replace current windows with high temperature glass consisting of (3) parallel glass panes. (CCA No. 105)	+2
Add LEM docking provisions for LOR.	+150
GUIDANCE & NAVIGATION	(+180)
Increase the Guidance and Navigation per recent weight report from MIT. Since NAA does not have weight control responsibility for the MIT design, the weight changes in their Weight and Balance Report will be considered as authorized changes.	+180
ENVIRONMENTAL CONTROL	(-11)
Add a CO ₂ sensor to the ECS as a part of the ECS operational instrumentation. (CCA No.43)	+2
Add a surge tank to ECS and delete entry oxygen supply to provide early mission emergency gas flows. (CCA No. 52)	-7
Deletion of regenerative heat exchanger from the ECS heat exchanger package. (CCA No. 63)	-7
Decrease pressure suit gas flow requirement for ventilation flow from 12 CFM to 10 CFM. (CCA No. 123)	+1
INSTRUMENTATION	(+7)
Increase the PCM output bit rate from 31,000 to 51,200 bit/sec. This change was originally considered to have negligible weight affect but has henceforth been reported by Collins to cause a seven pound increase. (CCA No. 44)	+7

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~~CONFIDENTIAL~~COMMAND MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES**ELECTRICAL POWER** (+9)

Add two batteries to provide a source of power, separate from the primary D.C. power, to initiate pyrotechnic devices. (CCA No. 28) +10

Delete automatic LES tower ejection function from flight sequencer for normal missions. (CCA No. 91) -1

COMMUNICATIONS (+33)

Add a spacecraft up-data link for the purpose of providing current GOSS data within the spacecraft for display and comparison with the on-board computed data. (CCA No. 54) +35

Change the present two speed data storage to a three speed machine to provide fast dump of data. (CCA No. 59) -2

CONTROLS & DISPLAYS (+21)

Furnish and install a clock timer panel at the navigation station lower equipment bay. (CCA No. 84) +2

Increase G & N navigation controls coded to controls and displays per MIT status. +6

Add rendezvous radar for LOR. +13

TOTAL COMMAND MODULE WEIGHT EMPTY CHANGES +516~~CONFIDENTIAL~~

~~CONFIDENTIAL~~COMMAND MODULE WEIGHT HISTORYUSEFUL LOAD AUTHORIZED CHANGES

SUITS & PERSONAL EQUIPMENT

(-8)

Change the following GFE (NASA) responsibility items:

Increase personal radiation dosimeters per NASA Crew Systems Meeting Number 19, Action Item Number 6.	+10
Increase PLSS per Hamilton Standard status.	+36
Delete initial charge water for coolant, from PLSS, as this item is now carried in the potable water tank.	-5
Delete one PLSS consistent with requirements for LOR mission.	-48
Delete primary oxygen from remaining PLSS.	-1

TOTAL COMMAND MODULE USEFUL LOAD CHANGES

-8

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~~CONFIDENTIAL~~WEIGHT HISTORYSERVICE MODULE

ITEM	DESIGN GOAL	AUTHORIZED CHANGES	DESIGN GOAL ADJUSTED 4-1-64
Structure	3203	+40	3243
Environmental Control	250		250
Instrumentation	100		100
Electrical Power	1203		1203
Propulsion System			
Engine Installation	606		606
Propellant System	2456		2456
Reaction Control	737		737
Communications & Rendezvous Radar	45	+120	165
WEIGHT EMPTY	8600	+160	8760
Usable RCS Propellant	611		611
Usable Fuel Cell Reactants	479		479
Environmental Control Fluids	193		193
Main Propulsion Helium	139		139
Main Prop. Residuals	900		900
Unusable RCS Propellant	61		61
Unusable Fuel Cell Reactants	17		17
BURNOUT WEIGHT	11000	+160	11160
Main Propellant	45000		45000
GROSS WEIGHT	56000	+160	56160

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~~CONFIDENTIAL~~SERVICE MODULE WEIGHT HISTORYWEIGHT EMPTY AUTHORIZED CHANGES

STRUCTURE	(+40)
Add structural beef-up required to support the rendezvous radar equipment.	+40
COMMUNICATION & RENDEZVOUS RADAR	(+120)
Add rendezvous radar equipment consistent with the LOR requirements.	+120
	<hr/>
TOTAL SERVICE MODULE WEIGHT EMPTY CHANGES	+160

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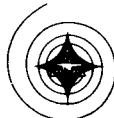
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POTENTIAL WEIGHT CHANGES

COMMAND MODULE

ITEM	AIRFRAME O11	LOR SPACECRAFT
<u>STABILIZATION & CONTROL</u>	(-)	(-34)
Utilize magnesium in lieu of aluminum on ECA base plates.		-25
Change internal package connectors from Amphenol to Cannon based on recent connector optimization study.		-9
<u>GUIDANCE & NAVIGATION</u>		(-95)
Incorporate simplified G & N system for Block II vehicles.		-95
<u>CREW SYSTEMS</u>	(-)	(-90)
Change in crew and metabolic criteria based on astronaut data and new NASA metabolic rates.		
Crew		-49
Food and Containers		-12
Decrease mission duration from 14 days to 9 days:		
Food and Containers		-29
<u>ENVIRONMENTAL CONTROL SYSTEM</u>	(+5)	(+25)
Reduce lithium hydroxide and container per change in Crew and Metabolic criteria based on astronaut data and new NASA metabolic rates.		-18
Add wiring for control of fan heaters in lieu of hemispherical heaters in the supercritical storage system.	+5	+5
Reduce quantity requirements of lithium hydroxide due to mission duration decrease from 14 days to 9 days.		-37
Add installation control provisions for the Service Module temperature control system.		+10

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POTENTIAL WEIGHT CHANGES

COMMAND MODULE

ITEM	AIRFRAME 011	LOR SPACECRAFT
<u>STRUCTURE</u>	(+184)	(+137)
Increase ablator consistent with current AVCO status. NAA is currently studying AVCO's ablator thicknesses and densities versus new heating rates.	+159	+159
Increase honeycomb bonding due to a change in adhesive bonding specification for the Apollo spacecraft requiring increases in the bonding thicknesses in the splicing areas.	+25	+25
Decrease ablator due to adding a full boost protective cover eliminating boost ablator and adding thermal paint reducing entry temperatures.		-150
Redesign forward apex to reflect a flat top forward heat shield cover.		-83
Redesign the forward end inner structure to increase the forward tunnel diameter and change to a single point attach for the earth landing system.		-56
Redesign crew compartment heat shield to improve Station 43 frame design and to reduce the quantity of heat shield panels. (25 pounds of this change is currently incorporated into LOR vehicle.)		-15
Redesign side access hatch for crew transfer and design improvement.		-14
Redesign Launch Escape System attachment to the forward end of the Command Module. (17 pounds for tower well fitting redesign and 12 pounds for extending longerons to improve loads.)		-29
Add micrometeoroid shielding required to protect the Command Module sufficiently during sporadic (omnidirectional) activity to produce .9999 probability of mission success.		+310

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POTENTIAL WEIGHT CHANGES

COMMAND MODULE

ITEM	AIRFRAME 011	LOR SPACECRAFT
<u>ENVIRONMENTAL CONTROL SYSTEM (Cont.)</u>		
Add 100 per cent humidity design:		+65
Stabilization & Controls	+18	
Guidance & Navigation	+4	
Instrumentation	+8	
Electrical Power	+9	
Communication	+16	
Controls & Displays	+10	
<u>EARTH LANDING SYSTEM</u>	(-)	(-100)
Incorporate Block II configuration reducing main parachute design "q" from 64 to 45-50 "q" thereby reducing design limit load from 24K to 18K.		-100
<u>ELECTRICAL POWER SYSTEM</u>	(-)	(+85)
Increase electrical Command Module to Service Module umbilical consistent with potential intermodular wiring requirement.		+85
<u>COMMUNICATION</u>	(-11)	(-24)
Repackage PCM components		-18
Redesign S-Band and FM/PM equipment to enable ground tracking of S/C during transmission of S-Band Frequency Modulation Modes and permit simultaneous transmission of PM and FM data.		+15
Decrease spares per reliability studies.	-11	-11
Relocate VHF/2 KMC Antenna to the Service Module.		-40
Add a teleprinter to provide direct display readout from the digital up-data link.		+30

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~~CONFIDENTIAL~~POTENTIAL WEIGHT CHANGESCOMMAND MODULE

ITEM	AIRFRAME 011	LOR SPACECRAFT
<u>CONTROLS AND DISPLAYS</u>	(+1)	(+13)
Add control panel for the Service Module cryogenic fan heaters.	+1	+1
Expand Caution and Warning System.		+10
Add control for Service Module cryogenic fan heaters.	+1	+1
<u>SCIENTIFIC EQUIPMENT</u>	(-)	(-170)
Remove from Lower Equipment Bay.		-35
Remove from Right Hand Equipment Bay.		-135
TOTAL POTENTIAL WEIGHT CHANGES - COMMAND MODULE	+179	-243

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POTENTIAL WEIGHT CHANGES

SERVICE MODULE

ITEM	AIRFRAME 011	LOR SPACECRAFT
<u>STRUCTURE</u>	(+117)	(+12)
Increase honeycomb bonding due to a change in adhesive bonding specification for the Apollo spacecraft requiring increases in the bonding thicknesses in the splicing areas.	+92	+92
Increase engine mount and backup structure due to engine stiffness requirements.	+25	+25
Decrease basic structure and equipment supports due to modifications to save weight.		-200
Add micrometeoroid shielding required to protect the Service Module sufficiently during sporadic (omni-directional) activity to produce .9999 probability of mission success.		+95
<u>ENVIRONMENTAL CONTROL</u>	(-)	(+230)
Addition of S/M temperature control system to provide required heating or cooling to the Reaction Control System and Service Propulsion Systems.		+230
<u>ELECTRICAL POWER</u>	(+54)	(-117)
Reduce H ₂ for 9 day mission in lieu of 14 day.		-12
Reduce O ₂ for 9 day mission in lieu of 14 day.		-192
Decrease fuel cell based on reductions under study of P & W utilizing a gas manifold, light weight pump rotor, a redesigned glycol pump, and nickel clad steel electrode back-up plates.		-32
Increase electrical Command Module to Service Module umbilical consistent with potential intermodular wiring requirement.		+65

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~~CONFIDENTIAL~~POTENTIAL WEIGHT CHANGESSERVICE MODULE

ITEM	AIRFRAME 011	LOR SPACECRAFT
<u>ELECTRICAL POWER (Cont.)</u>		
Add Service Module destruct system.	+50	+50
Replace hemispherical heaters with fan heaters in the cryogenics tanks.	-11	-11
Increase O ₂ tank outer shell and insulation per Beech status.	+15	+15
<u>PROPULSION</u>	(+62)	(+147)
Add tank slosh baffles or screens.		+150
Reduce SPS propellant tank gauge.		-65
Increase propellant tanks due to changing to the maximum tolerance in lieu of 60 per cent tolerance.	+46	+46
Increase engines due to redesign of fuel and oxidizer valve per Aerojet report.	+16	+16
<u>REACTION CONTROL</u>	(+30)	(+30)
Increase engine weight per current Marquardt test model.	+18	+18
Increase RCS engine support housing due to redesign to accommodate increased dynamic loads.	+12	+12
<u>COMMUNICATIONS</u>	(-)	(+40)
Relocate the VHF/2KMC Antenna from the Command Module		+40
TOTAL POTENTIAL WEIGHT CHANGES - SERVICE MODULE	+263	+342

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~~CONFIDENTIAL~~POTENTIAL WEIGHT CHANGESLAUNCH ESCAPE SYSTEM

ITEM	AIRFRAME 011	LOR SPACECRAFT
Reduce tower insulation based on redefined boost and re-entry heating rates and raising the titanium allowable temperature to 800°F.	-95	-95
Add a full boost protective cover that will be jettisoned simultaneously with the LES.		+565
TOTAL POTENTIAL WEIGHT CHANGES - LAUNCH ESCAPE SYSTEM	-95	+470

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~~CONFIDENTIAL~~POTENTIAL WEIGHT CHANGESADAPTER

ITEM	AIRFRAME 011	LOR SPACECRAFT
Increase honeycomb bonding due to a change in adhesive bonding specification for the Apollo spacecraft requiring increases in the bonding thicknesses in the splicing area.	+65	+200
Increase LEM Adapter based on SID/GAEC Meeting No. 36, 21, 22 January 1964, in which MSFC has requested space allocation and support off of SLA for electronic equipment, estimated total weight 360 pounds.		+410
Electronic Equipment +360		
Supports +50		
TOTAL POTENTIAL WEIGHT CHANGES - ADAPTER	+65	+610

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULESUMMARY

ITEM		CURRENT WEIGHT 4-1-64
<u>WEIGHT EMPTY</u>		8657
Structure	4699	
Stabilization & Control	226	
Guidance & Navigation	451	
Crew Systems	422	
Environmental Control	294	
Earth Landing System	704	
Instrumentation	296	
Electrical Power	556	
Reaction Control	330	
Communications	360	
Controls & Displays	319	
<u>USEFUL LOAD</u>		1543
Scientific Equipment	250	
Crew Systems	882	
Reaction Control	270	
Environmental Control	141	
GROSS WEIGHT		10200

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DETAIL WEIGHT STATEMENT
COMMAND MODULE
STRUCTURE

ITEM		CURRENT WEIGHT 4-1-64
<u>STRUCTURE</u>		
Inner Structure		(1056)
Forward Section		203
Honeycomb	63	
Frames, Rings, Hatches & Mechanism	57	
Fittings & Attachments	83	
Center Section		664
Honeycomb Panel	196	
Longerons, Frames & Rings	263	
Windows, Hatches & Mechanism	104	
Fittings & Attachments - H.S.	101	
Aft Section		189
Honeycomb Panel	110	
Ring & H.S. Attach	79	
Secondary Structure		(574)
RH Equipment Bay & Coldplates		84
LH Equipment Bay		80
Fwd. LH Equipment Bay		20
Fwd. RH Equipment Bay & Coldplates		19
Main Display Panel & Coldplates		60
Lower Equipment Bay & Coldplates		200
Aft Equipment Bay		63
Crew Area		5
Heat Shield Equipment Area		43
Heat Shield Substructure		(1429)
Forward Section		195
Honeycomb Panels & Closeouts	109	
Frames, Rings & Access. Doors	35	
Fittings, Attach & Mechanism	51	
Center Section		705
Honeycomb Panels & Closeouts	247	
Frames and Rings	114	
Access Doors, Windows & Hatch Covers	186	
Fittings, Mechanism & Attach. H.S.	134	
Air Vent	24	
Aft Section		529
Honeycomb Panels & Closeouts	350	
Frames & Rings	47	
Fittings & Attach H.S.	84	
Toroidal Assembly	48	
Ablation Material		(1273)
Forward Section		116
Center Section		529
Aft Section		628
Insulation		(195)
Separation Provisions and Attachments		(22)
LEM Docking		<u>(150)</u>
TOTAL STRUCTURE		4699

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULESTABILIZATION AND CONTROL

ITEM	CURRENT WEIGHT 4-1-64
<u>STABILIZATION AND CONTROL</u>	
Lower Equipment Bay	(171.6)
Rate Gyro Package	7.5
Body Mounted Gyro Package	12.8
Electronic Control Package - Pitch	28.3
Electronic Control Package - Roll	28.6
Electronic Control Package - Yaw	28.9
Electronic Control Package - Auxiliary	28.8
Display/BMAG ECA Package	36.7
Spares - Lower Equipment Bay	(14.5)
Spare Gyro - BMAG (2)	2.0
Spare Gyro - Rate	.5
Spare Plug-In Module	12.0
Electrical Provisions	(39.9)
Wiring, etc.	39.3
SCS Power, Junction Box	<u>.6</u>
TOTAL STABILIZATION AND CONTROL	226.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEGUIDANCE & NAVIGATION

ITEM	CURRENT WEIGHT 4-1-64
<u>GUIDANCE AND NAVIGATION</u>	
Electronic Equipment	(269.8)
Inertial Measurement	60.2
Navigation Base	27.2
Computer & Spare Tray	70.0
Computer Stored Spares	25.0
Power Servo Assembly	59.4
Coupling Display Unit	14.5
Bellows Assembly	13.5
Optical Equipment	(48.7)
Sextant	14.6
Telescope	13.8
Optical Base	16.7
Optical Eyepieces	3.6
Coolant Hoses	(1.0)
Electrical Provisions	(69.9)
Cabling MIT	43.2
Cabling NAA	26.7
Loose Stored Items	(61.6)
Film Cartridges (4)	2.4
Computer Loose Spares	34.6
Power Servo Assembly Loose Spares	16.7
CDU Spare Gear Box	2.5
Spare Relay & Diode Module	.3
Eye Relief Eyepiece	1.5
Horizon Photometer	3.6
TOTAL GUIDANCE AND NAVIGATION	451.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>CREW SYSTEMS</u>	
Crew Accessories	(3.0)
Egress Accessories - Hatch	3.0
Crew Couch/Seat & Restraint System	(379.9)
Pad Assembly Couch	7.0
Harness Assembly - Restraint	12.0
Restraint Assembly - Rest Station	4.0
Restraint Assembly - Lower Equipment Bay	2.0
Sandal - Weightless Restraint	2.0
Structure - Lock & Release	265.9
Structure - Support & Attenuation	87.0
Window Filter Assemblies	(3.8)
Food & Associated Equipment	(8.4)
Shelf Assy. - Work/Food Preparation	1.9
Food Storage Boxes	5.0
Delivery Assy. - Water	1.5
Waste Management System	(2.7)
Crew Equipment	(24.2)
Umbilical Assy	17.9
Hose Assy - PLSS O ₂ Recharge	2.8
Electrical Umbilical - PGA	2.5
Constant Wear Garment Stowage	<u>1.0</u>
TOTAL CREW SYSTEMS	422.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>ENVIRONMENTAL CONTROL SYSTEM</u>	
Pressure Suit Circuit	(88.5)
Subcontractor Compressor, Heat Exchg., Val. & Cont.	70.8
Ducting, Conn., Clamps, & Compr. Sel. Sw.	15.7
CO ₂ Sensor	2.0
Water-Glycol Circuit	(68.8)
Subcontractor Res., Evaporator, Pump, Val. & Cont.	35.4
Water-Glycol	18.4
Plumbing & Glycol Pump Sel. Sw.	15.0
Pressure & Temp. Control	(19.1)
Subcontractor Heat Exchg., Blower, Val. & Cont.	16.7
Ducting & Cabin Blower Sel. Sw.	2.4
Oxygen Supply System	(15.9)
Subcontractor Val. & Cont.	5.2
Plumbing	3.5
Oxygen Surge Tank	7.2
Water Supply System	(27.6)
Subcontractor Potable & Waste Tanks	24.2
Plumbing	3.4
Subcontractor Common Items	(27.5)
Brackets, Plumbing, Elect. Wiring	13.0
Instrumentation	14.5
S&ID Common Items	(27.8)
Nitrogen Purge System	2.8
Supports	11.6
Electrical Provisions	9.8
Manual Control - Push Pull	3.6
Waste Management System	(18.8)
TOTAL ENVIRONMENTAL CONTROL SYSTEM	294.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEEARTH LANDING SYSTEM

ITEM	CURRENT WEIGHT 4-1-64
<u>EARTH LANDING SYSTEM</u>	
Parachute System	(590.5)
Drogue Chute System	79.6
Main Cluster	426.7
Disconnect Main Cluster	3.1
Pilot Chute System	30.6
Sequence Control	8.5
Attach Provisions	42.0
Location Aids	(5.3)
Forward Heat Shield Release System	(52.5)
Drogue Disconnect Installation	(9.6)
Electrical Pyrotechnic Initiation Provisions	(6.0)
Crushable Honeycomb - Impact Attenuation	<u>(40.1)</u>
TOTAL EARTH LANDING SYSTEM	704.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTCOMMAND MODULEINSTRUMENTATION

ITEM	CURRENT WEIGHT 4-1-64
<u>INSTRUMENTATION</u>	
Remote Equipment	(47.0)
Sensors	35.0
Nuclear Radiation Detection Provisions	6.0
TV Camera	4.5
TV Viewfinder	1.5
Lower Equipment Bay	(58.1)
PCM Unit No. 1	26.6
PCM Unit No. 2	21.1
Nuclear Radiation Detection Equipment	11.0
Right Hand Bay Forward	(36.0)
Inflight Test System	
Comparators and Power Supply	16.5
Lamps	1.9
Switches	1.5
Meter	1.0
Chassis	9.0
Harness	4.1
Access Cable	2.0
Electrical Provisions	(154.9)
Inflight Test Electrical Provisions	25.0
Data Distribution Panel	2.3
Instrumentation Electrical Provisions	127.6
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TOTAL INSTRUMENTATION	296.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>ELECTRICAL POWER</u>	
Energy Source	(77.8)
Battery - Re-Entry (2)	44.2
Battery - Post Landing (1)	22.1
Battery - Pyrotechnic - Installation	10.0
Battery Vent System	1.5
Power Conversion	(121.0)
Inverter (3) & Control	117.0
Battery Charger & Controls	4.0
Power Distribution & Control	(94.6)
D-C Power Panel Assy	7.6
A-C Power Box Assy	10.5
Battery Circuit Breaker Panel	3.4
Lower Equipment Bay Panel	4.2
Terminal Distribution Panel (Bus)	9.6
Circuit Breaker Panel	4.7
Electrical Transmission (Wiring, Connectors, Cond., Sup.)	30.1
Ground Power Provisions	4.5
Power Control Panel Connectors	3.0
Installation Provisions	10.0
Phase Correcting Capacitor	6.0
Inverter Bus Selection Control	1.0
Electrical Common Utility	(256.1)
Electrical Transmission (Wiring, Conn., Cond., & Sup.)	102.2
Right Hand Circuit Breaker Panel	17.1
Left Hand Circuit Breaker Panel	10.9
Lighting	2.5
Adapter Separation System	2.5
LES Separation System	15.1
Circuit Utilization Package	6.3
Sequencer	39.1
Installation Provisions	15.8
C/M to S/M Separation System Wiring & Hardware	9.2
SPS Electrical Provisions - S/M	19.3
RCS Electrical Provisions - S/M	11.1
Booster - S/C Separation Sequencer	5.0
Lighting Equipment	<u>(6.5)</u>
TOTAL ELECTRICAL POWER	556.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>REACTION CONTROL SYSTEM</u>	
Propellant System	(73.5)
Oxidizer System	37.2
Tanks & Expulsion Devices	15.0
Plumbing, Fittings & Insulation	11.4
Valves & Regulators	10.3
Sensors	.5
Fuel System	36.3
Tanks & Expulsion Devices	14.1
Plumbing, Fittings & Insulation	11.4
Valves & Regulators	10.3
Sensors	.5
Pressure System	(55.4)
Tanks (4500 psi)	9.5
Plumbing, Fittings & Insulation	4.8
Valves & Regulators	38.6
Sensors	2.5
Engine System	(132.0)
Engines	90.0
Nozzle Extension	42.0
Electrical Provisions	(36.7)
Dumping System	(32.4)
Valves & Supports	13.0
Controls & Electrical Provisions	12.0
Plumbing & Fittings	5.0
Miscellaneous	2.4
<hr/>	
TOTAL REACTION CONTROL SYSTEM	330.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>COMMUNICATIONS</u>	
Lower Bay	(241.3)
C-Band Transponder	22.8
Unified S-Band	30.9
S-Band Power Amplifier	17.5
VHF-FM Transmitter/HF Transceiver	15.4
VHF AM Trans. - Rec/VHF Rec. Bea.	15.1
Multiplexer	11.0
Signal Conditioner	40.0
Recorder	25.4
Audio Center	8.0
Premodulation Processor	14.2
Central Timing Equipment	8.0
Up Data Link and Provisions	24.0
VHF-HF Diplexer	1.7
VHF-UHF Diplexer	1.5
S-Band P.A. Spare Traveling Wave Tube	1.3
S-Band P.A. Spare Power Supply	4.5
Remote Equipment	(57.3)
VHF-HF Recovery Antenna & Transmission	11.4
C-Band Antenna & Transmission	11.7
2-KMC High Gain Antenna and Transmission	4.4
VHF-2 KMC Omni Ant., Trans. & Instl. Prov.	29.8
Electrical Provisions	(42.4)
Electrical Wiring	29.6
Data Distribution Panel	1.5
Coax	5.2
Connectors	6.1
Spares	(19.0)
TOTAL COMMUNICATIONS	360.0

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NORTH AMERICAN AVIATION, INC.



SPACE and INFORMATION SYSTEMS DIVISION

DETAIL WEIGHT STATEMENT

COMMAND MODULE
CONTROLS AND DISPLAYS

CURRENT
WEIGHT
4-1-64

ITEM

MAIN DISPLAY PANEL

Main Display Panel Control Station	(59.6)
SCS Mode Select	3.0
Delta Velocity	3.1
Flight Director Attitude Indicator	11.1
Attitude Set and Gimbal Position Display	4.8
SPS Gimbal Actuator	.5
Entry Monitoring Indicator	15.0
Launch Vehicle Emergency Detection System C-1	4.7
Master Caution and Abort Lt.	.3
IFTS Switch	.1
Barometric Indicator Light	.1
Event Timer	1.5
Mounting Panels	2.4
Rendezvous Radar	13.0

Main Display Panel Center Station	(65.7)
Audio Panel	1.2
Abort Light	.2
Reaction Control	11.2
GMT Readout	.8
ECS Gages and Controls	6.6
Crew Safety Controls	1.6
High Gain Antenna Control	2.5
G & N Computer Keyboard	19.5
Radiation Displays	3.0
Cryogenic	4.2
Caution and Warning Display	4.8
Mounting Panels	10.1

Main Display Panel System Management Station	(31.5)
Communications Control Panel	4.0
Master Caution Lights	.2
Power Distribution	6.1
Fuel Cells Controls	4.7
Service Propulsion	8.9
IFTS Switch	.1
Oxygen Warning	.1
Mounting Panels	7.4

Main Display Panel RH Console	(10.5)
Bus Switches	5.7
Audio Panel	1.2
Lighting Control	1.6
Mounting Panels	2.0

Main Display Panel LH Console	(7.9)
Mission Sequence Controls	1.0
Lighting Control	1.6
Audio Panel	1.2
SCS Power Control	2.2
Mounting Panels	1.9

57

TOTAL MAIN DISPLAY PANEL (To be brought forward)

SID 62-99-26
175.2

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ITEM	CURRENT WEIGHT 4-1-64
REMOTE EQUIPMENT	
Lower Equipment Bay	(51.4)
Lighting Control Panel	1.2
G & N Controls and Displays	50.2
Map and Data Viewer	7.7
Display and Control - Navigation	22.9
Display and Control - Computer	19.6
Left Hand Forward Equipment Bay	(3.0)
Clock	.8
Event Timer	2.0
Mounting Panel	.2
Crew Area Controls	(17.5)
Manual Control - Rotation	9.1
Manual Control - Translational	8.4
Caution and Warning	(22.0)
Detector	19.5
Spares	2.5
Electrical Provisions	(49.9)
Electrical Wiring	49.2
SCS/G & N Display Junction Box	.7
TOTAL REMOTE EQUIPMENT	143.8
TOTAL MAIN DISPLAY PANEL	175.2
TOTAL CONTROLS AND DISPLAYS	319.0

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DETAIL WEIGHT STATEMENTCOMMAND MODULEUSEFUL LOAD

ITEM	CURRENT WEIGHT 4-1-64
<u>CREW SYSTEMS</u>	
Government Furnished Equipment	(672.6)
Pressure Garment Assembly (3)	60.6
Portable Life Support System (1)	42.0
Garments - Constant Wear	8.4
Biomedical Instrumentation	2.0
Personal Radiation Dosimeters	11.8
Thermal Coverall	19.8
Crew (50, 70, 90 Percentile)	528.0
Food and Associated Equipment	(82.0)
Food	67.5
Food Containers	12.5
Food Mouthpiece - Personal	2.0
Crew Accessories	(18.5)
Flight Kit Assy.	12.0
Light Assy. - Portable	3.0
Tool Set - Inflight Maintenance	3.5
Crew Equipment	(1.0)
Belt Assembly - Inflight Maintenance	1.0
Waste Management	(1.5)
Medical Equipment	(12.1)
Personal Hygiene Equipment	(15.6)
Provisions Assembly - Crew Survival	(73.6)
Personal Communications	<u>(5.1)</u>
TOTAL CREW SYSTEM (To be brought forward)	882.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>REACTION CONTROL</u>	(270.0)
Usable Propellant	225.0
Residual Propellant	44.0
Trapped - System	30.8
Mixture Ratio	2.7
Expulsion Efficiency	7.8
Loading Tolerance	2.7
RCS Helium	1.0
<u>ENVIRONMENTAL CONTROL</u>	(141.0)
Lithium Hydroxide	104.0
Activated Charcoal	3.8
Containers for LiOH & Charcoal	12.0
Oxygen - Re-Entry	3.7
Water-Earth Orbit Cooling & Drinking	3.5
Water-Boost Cooling	4.0
Water-Emergency Re-Entry Cooling	6.0
Chemical Disinfectant	4.0
<u>SCIENTIFIC EQUIPMENT</u>	(250.0)
TOTAL This page	661.0
TOTAL CREW SYSTEM (Brought forward from Page 59)	882.0
TOTAL USEFUL LOAD	1543.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTSERVICE MODULESUMMARY

ITEM		CURRENT WEIGHT 4-1-64
<u>WEIGHT EMPTY</u>		(7785)
Structure	2290	
Environmental Control	90	
Instrumentation	132	
Electrical Power	1426	
Propulsion	3064	
Reaction Control System	601	
Communications	62	
Rendezvous Radar	120	
<u>USEFUL LOAD</u>		(2230)
Reaction Control	838	
Electrical Power	503	
Environmental Control	208	
Propulsion	681	
BURNOUT WEIGHT		10015
MAIN PROPELLANT		37020
GROSS WEIGHT		47035

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ITEM	CURRENT WEIGHT 4-1-64
<u>STRUCTURE</u>	
Basic Body Structure	(1616)
Honeycomb Panels	561
Frame and Rings	6
Access Doors	15
Fittings and Attach Parts	48
Radial Beams	373
Internal Partitions	25
Forward Bulkhead	161
Aft Bulkhead	305
RCS Panels	122
Secondary Structure	(185)
Tank Support Shelf	29
Engine Support Structure	54
Antenna Support Structure	50
Aft Heat Shield	52
Insulation	(299)
Separation Provisions and Attachments	(16)
Fairing - C/M to S/M	(144)
Miscellaneous	(30)
TOTAL STRUCTURE	2290

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ITEM	CURRENT WEIGHT 4-1-64
<u>ENVIRONMENTAL CONTROL SYSTEM</u>	
Water-Glycol Circuit	(76.2)
Subcontractor Valves & Controls	10.5
Plumbing and Hardware	20.5
Water - Glycol	10.0
Space Radiator (Outer Skin)	35.2
Water Supply System	(6.6)
Plumbing and Hardware	6.6
Oxygen Supply System	(3.0)
Plumbing and Supports	3.0
Common Items	(4.2)
Supports	2.9
Wiring	1.3
TOTAL ENVIRONMENTAL CONTROL SYSTEM	90.0

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ITEM	CURRENT WEIGHT 4-1-64
INSTRUMENTATION	
Instrumentation Sensors	(29.0)
Electrical Provisions	(98.0)
Supports	(5.0)
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TOTAL INSTRUMENTATION	132.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>ELECTRICAL POWER</u>	
Fuel Cell Power System	(1219.9)
Fuel Cell Power Pack (Incl. Mount Instrumentation)	738.9
Intermodular- Radiator Plumbing	47.5
Fuel Cell Module Mount Attach	1.1
Fuel Cell H ₂ System	
Subcontractor Components	153.2
Plumbing and Valves	5.5
Fuel Cell and ECS O ₂ System	
Subcontractor Components	176.6
Plumbing and Valves and Supports	31.7
Water Glycol - Fuel Cell Heat Transfer System	7.0
Elect. Wiring - Supercritical Gas	3.7
Space Radiator (Outer Skin)	40.5
Fuel Cell Module Stabilization Webs	2.9
Fuel Cell Plumbing Supports	6.0
Valve Module Control Box (Cryogenic Gas)	5.3
Power Distribution	(89.5)
Electrical Transmission	58.7
Power Distribution Box	30.8
Electrical Common Utility	(116.6)
Electrical Transmission	44.6
Sequencer	28.0
Adapter Separation System	1.4
C/M to S/M Separation System	12.5
Pyrotechnic Initiation	12.0
Provisions	10.7
LES Separation System Wiring & Hardware	<u>7.4</u>
 TOTAL ELECTRICAL POWER	 1426.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>MAIN PROPULSION</u>	
Propellant Systems	(1395.0)
Oxidizer System	779.3
Tanks & Doors	557.0
Skirts	59.8
Plumbing, Fittings & Insulation	53.0
Valves	4.5
Quantity Indication	25.5
Mixture Ratio Control	14.0
Supports - Plumbing & Equipment	43.5
Retention Reservoir	22.0
Fuel System	615.7
Tanks & Doors	458.0
Skirts	33.2
Plumbing, Fittings & Insulation	42.0
Valves	4.5
Quantity Indication	25.5
Supports - Plumbing & Equipment	31.5
Retention Reservoir	21.0
Pressure System	(925.0)
Tanks (4400 psi)	784.0
Tanks Supports	30.0
Plumbing, Fittings & Insulation	24.0
Valves, Regulators & Heat Exchanger	49.0
Supports - Plumbing & Equipment	38.0
Engine System	(712.0)
Engine	687.0
Closeouts - Throat to S/M	25.0
Electrical Provisions	(32.0)
TOTAL MAIN PROPULSION SYSTEM	3064.0

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ITEM	CURRENT WEIGHT 4-1-64
<u>REACTION CONTROL SYSTEM</u>	
Propellant Systems	(186.4)
Oxidizer System	95.1
Tanks & Expulsion Devices	34.4
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	12.0
Sensors	3.0
Supports	18.2
Quantity Gaging	19.0
Fuel System	91.3
Tanks & Expulsion Devices	31.6
Plumbing, Fittings & Insulation	8.5
Valves & Regulators	12.0
Sensors	3.0
Supports	18.2
Quantity Gaging	18.0
Pressure System	(128.0)
Tanks (4500 psi)	19.0
Plumbing, Fittings & Insulation	6.0
Valves & Regulators	76.0
Sensors	7.0
Supports	20.0
Engine System	(175.2)
Engines	75.2
Reflectors & Insulation	100.0
Structural Provisions	(80.0)
Electrical Provisions	<u>(31.4)</u>
TOTAL REACTION CONTROL SYSTEM	601.0

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DETAIL WEIGHT STATEMENT

SERVICE MODULE

COMMUNICATIONS & RENDEZVOUS RADAR

ITEM	CURRENT WEIGHT 4-1-64
<u>COMMUNICATIONS</u>	(62.0)
Remote Equipment	39.0
Gimbal - High Gain Antenna	12.2
Earth Sensor - High Gain Antenna	12.0
High Gain Antenna	4.8
Locking Provisions - High Gain Antenna	3.0
Boom - High Gain Antenna	7.0
Electrical Provisions	22.0
Wiring - Common Utility	13.0
Coax & Connectors - High Gain Antenna	9.0
Supports	1.0
<u>RENDEZVOUS RADAR</u>	(120.0)
Rendezvous Equipment	69.8
Radar Package	30.0
X-Band Dish Ant., Trans. & Sup.	17.8
Antenna Boom	10.0
Antenna Actuation Mechanism	10.0
Diplexer	2.0
Transponder Equipment	28.6
Transponder	10.0
X-Band Flush Mntd. Omni Ant. (3)	3.0
X-Band Trans. & Supports	12.6
X-Band Power Divider	1.0
Diplexer	2.0
Supports & Cooling Provisions	15.6
Rendezvous Equipment	9.6
Transponder Equipment	6.0
Electrical Provisions	6.0
Rendezvous Equipment	3.0
Transponder Equipment	3.0
TOTAL COMMUNICATION & RENDEZVOUS RADAR	182.0

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ITEM	CURRENT WEIGHT 4-1-64
REACTION CONTROL	(838.0)
RCS Propellant	835.0
Usable	790.0
Residual	45.0
Trapped System	4.0
Mixture Ratio	9.0
Expulsion Efficiency	24.0
Loading Tolerance	8.0
RCS Helium	3.0
ELECTRICAL POWER (Normal Mission)	(503.0)
Hydrogen - Supercritical Gas	58.5
Usable (Electrochemical Incl. Tolerance)	46.0
Unusable (Residual & Instrument Error)	3.2
Emergency Provisions	4.7
Expend (Leakage & Purge)	4.6
Oxygen - Supercritical Gas	444.5
Usable (Electrochemical Incl. Tolerance)	377.0
Unusable (Residual & Instrument Error)	17.5
Emergency Provisions	44.0
Expend (Leakage & Purge)	6.0
ENVIRONMENTAL CONTROL (Normal Mission)	(208.0)
Oxygen - Supercritical Gas	208.0
Usable (Metabolic)	76.5
Unusable (Residual & Instrument Error)	9.1
Emergency Provisions	25.3
Expend (Leakage, LEM, PLSS, Repress.)	97.1
PROPULSION	(681.0)
Main Propulsion Helium	99.0
Main Propellant Residuals	582.0
Trapped - System	225.0
Trapped - Engine	67.0
Mixture Ratio Tolerance	100.0
Loading Tolerance	190.0
TOTAL USEFUL LOAD (Less Main Propellant)	2230.0

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTLAUNCH ESCAPE SYSTEMSUMMARY

ITEM	CURRENT WEIGHT 4-1-64
<u>LAUNCH ESCAPE SYSTEM</u>	
Structure	(1314)
Tower Assy	301
Escape Motor Skirt	208
Pitch Motor Structure	560
Nose Cone and Ballast Support	35
Attaching Parts	14
Tower Insulation	186
Skirt Insulation	10
Separation Provisions	(13)
Ballast	(678)
Propulsion	(5340)
Escape Motor	4767
Jettison Motor	434
Jettison Motor Skirt	92
Pitch Control Motor	47
Electrical Power	(85)
C/M Boost Protection Cover	(185)
TOTAL LAUNCH ESCAPE SYSTEM	7615

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~~CONFIDENTIAL~~DETAIL WEIGHT STATEMENTADAPTERSUMMARY

ITEM	CURRENT WEIGHT 4-1-64
<u>ADAPTER</u>	
Structure	(3405)
Basic Body Structure	
Honeycomb Panels	2200
Longerons	46
Frames & Rings	306
Access Doors	50
Fittings & Attachings Parts	50
Secondary Structure	
LEM Supports	20
Insulation	218
Separation Provisions & Attach	435
Miscellaneous	80
Electrical Provisions	(70)
TOTAL ADAPTER	<hr/> 3475

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